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June 9, 2008

Department of Engineering
City of Rocky Mount, NC
P. O. Box 1180
Rocky Mount, NC 27802

Attention: Mr. William Kerr, P.E.
Director of Engineering

Reference: Nicodemus Road Widening
Rocky Mount, North Carolina
GeoTechnologies Project No. 1-08-0258-CA

Dear Sir:

GeoTechnologies has performed the authorized investigation of subsurface conditions along a 1300 foot section of Nicodemus Mile Road in Rocky Mount, North Carolina. The purpose of the investigation was to evaluate subsurface condition of the soils in a proposed road widening on the north side of the roadway. Borings were advanced to a depth of 6.5 feet below existing ground surface. During advancement of the borings, the consistency and density of the soils encountered were evaluated with a dynamic hand cone penetrometer. This report presents the findings of the investigation and our recommendation for installation of the proposed widening.

SITE DESCRIPTION

The site is located on Nicodemus Mile Road and extends approximately 1300 feet east from the intersection with Shearin Andrew Road. The pavements on the existing roadway exhibit both alligator cracking as well as shrinkage cracking. The area to be widened slopes downward to the north to a shallow swale which carries storm water. Several utilities including water and phone lines exist within 15 feet of the existing edge of pavement. A gas line crosses the widening alignment near the east end. A shallow ditch was present at the east end of the proposed widening section. The anticipated traffic count for Nicodemus Mile Road is 8500 ADT at full build out.

SUBSURFACE CONDITIONS

The area of the proposed widening is presently grassed with topsoil and root mat depths ranging from 2 to 4 inches. The topsoil is underlain predominantly by silty and clayey sands to boring termination depth that are very loose to medium dense in consistency. The soils in the upper 3 feet were generally wet of optimum moisture content. Borings B-1 and B-2 encountered backfill over utility lines. We believe that the utility encountered in the borings is a water line that runs along the shoulder. The backfill in the utility trenches was poorly compacted and wet of optimum moisture content. Water was encountered at the level of the utility in borings B-1 and B-2. Water was not encountered in the other test borings.

Thickness of the asphalt pavement on Nicodemus Mile Road ranged from 3 to 6 inches along the edge of the road. A previous investigation on Nicodemus Mile Road east of this site showed an average asphalt depth of 2.5 inches. Thicknesses measured at the edge of pavements are often thicker than the asphalt in the travel lane and it is likely that the majority of the pavements in the travel lane on the roadway are 3 inches or less based on our previous investigation.

English Road Pavement Depths

Thickness of the asphalt pavement on English Road was measured at 6 locations along the edge of the pavement. Asphalt depths ranged from 3 to 5 inches at the edge of pavement. The asphalt will be milled up from a section of English road in the near future. This material can be used as part of the aggregate base course section for the road widening.

Laboratory Test Results

A composite sample of the material from a depth of 1 to 3 feet was assembled from the test borings. The soils consist of slightly clayey to clayey silty medium to fine sands with a Unified Soil Classification of SC. These soils exhibited a maximum dry density of 122.1 pcf at an optimum moisture content of 11.0 percent when tested in accordance with ASTM D-698, Standard Proctor. A laboratory CBR test yielded a soaked CBR value of 13.8 percent at 0.1 inch penetration and 14.4 percent at 0.2 inch penetration. No swell was measured after 96 hours of soaking.

PAVEMENT DESIGN

Pavement designs were developed using the Wake Forest – AASHTO modified method for design of residential streets. Copies of the design calculations for the road widening are attached for your review as Table 2. A traffic volume (ADT) of 8500 at build-out was provided by the City of Rocky Mount. A traffic utilization of 4% single frame trucks, 1% multiple frame trucks, and 95 percent automobiles was used for design purposes. A structural coefficient 0.14 was used for the aggregate base course. A structural coefficient of 0.44 was used for the asphalt pavements. A CBR value of 12 percent was used for the design.

Based on a traffic volume of 8500 and a design CBR value of 12 percent, a pavement structural number of 3.01 is required for the pavement section in the road widening. A suitable pavement structure for this structural number would be 1.5 inches of S12.5A surface over 2.5 inches of I19.0 binder over 9 inches of aggregate base course stone.

An alternate pavement section for the widening would be to utilize cement stabilized base removed from other projects in the city and use it for base course material. If such material is available, the base depth can be reduced from 9 inches of untreated aggregate base course to 6.5 inches of cement stabilized base course.

CONSTRUCTION CONSIDERATIONS

Construction of the road widening should begin with the stripping of topsoil and root mat from the proposed alignment. The roadway should then be cut to proposed subgrade elevation. Because the soils below a depth of 12 inches were generally wet of optimum moisture, we recommend that tracked equipment be utilized for excavation of the pavement box, in order to minimize disturbance of the wetter soils below the subgrade elevation.

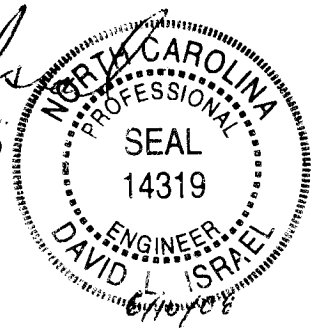
Once the site has been cut to subgrade elevation, we recommend that the subgrade be proof rolled with a loaded tandem axle dump truck to locate areas which may be unstable and require repair. The soils at the site are conducive to drying by discing and scarifying and the majority of the subgrade can likely be stabilized by this method. However, some undercutting may be required over utility lines which are located within the widening. We would also note that the compaction curve for the soils in the upper 2 feet was relatively steep which indicates that the range of moisture for achieving compaction of the soils will be fairly narrow. The soils will also tend to pump when they are more than 1 or 2 percent wet of optimum. We recommend that the subgrade soils be compacted to 100 percent of the standard Proctor maximum dry density at +/-2% of optimum moisture. Aggregate base course and asphalt materials should be produced and placed in accordance with NCDOT specifications.

GeoTechnologies appreciates the opportunity to be of service to the Department of Engineering for the City of Rocky Mount, North Carolina. We will be glad to meet with you at your convenience to answer any questions you may have once you have had the opportunity to review the report and the attached data.

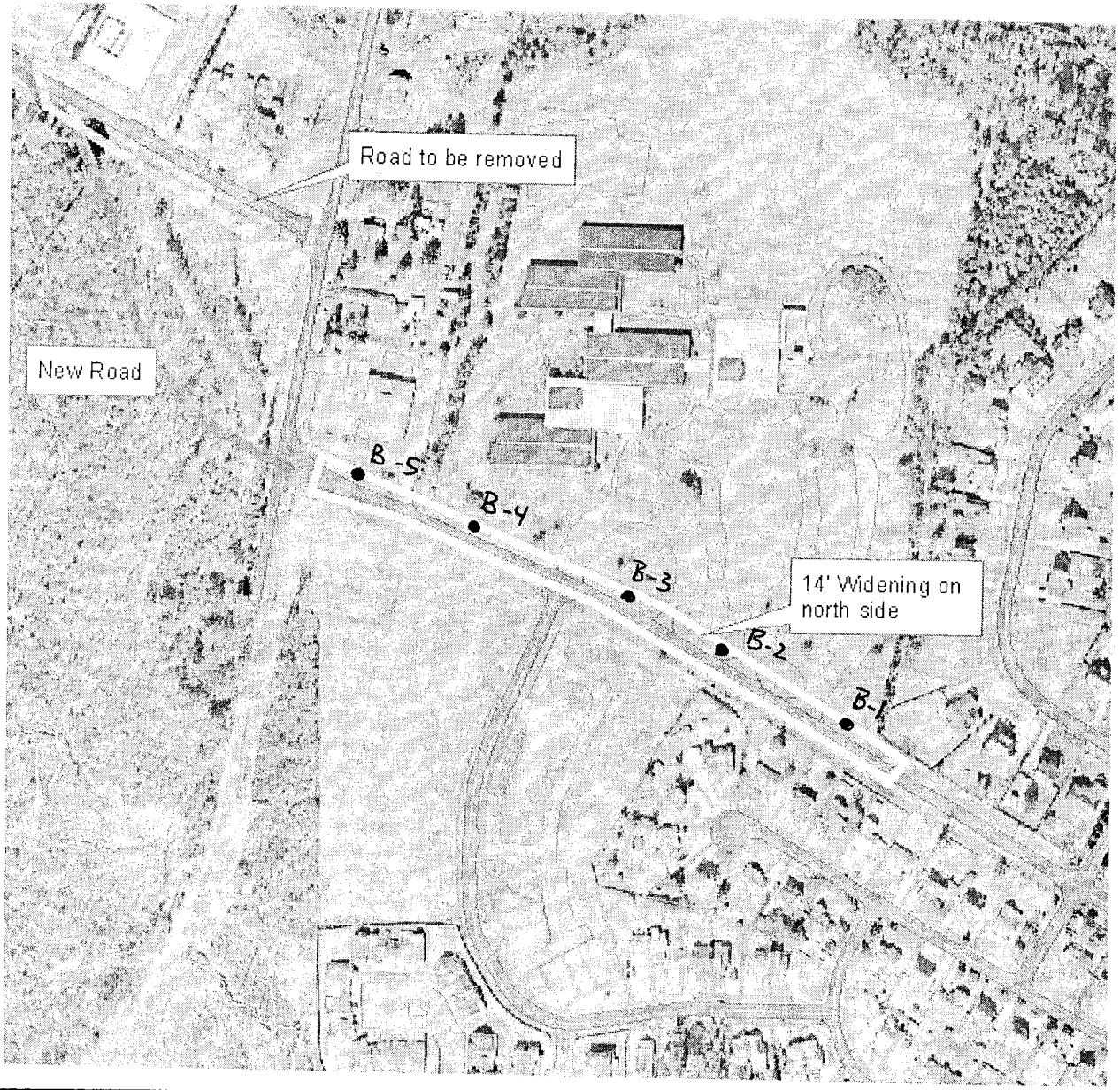
Sincerely,

GeoTechnologies, Inc.

David L. Israel, P.E.
NC Reg. No. 14319



WB-DRH/DLI
Attachments



Nicodemus Mile Road Widening Rocky Mount, North Carolina	SITE PLAN BORING LOCATIONS	Project No. 1-08-0258-CA Figure No. 1 Scale: Not To Scale

TABLE 1

TEST BORING SUMMARY

Nicodemus Mile Road Widening
Rocky Mount, North Carolina
GeoTechnologies Project No. 1-08-0258-CA

Boring	Depth (in.)	Description	Dynamic Cone Penetrometer Depth (in.)	Blows / 1.75"
B-1	0 - 3	Topsoil		
	3 - 15	Fill - Loose Dense Gray Brown Silty Fine SAND	12	9-11-7
	15 - 50	Fill - Loose to Very Loose Light Brown Clayey Medium to Fine SAND (Wet)	24	3-3-2
	50	Water Line	42	4-1-1
			60	8-15/1.75"
B-2	0 - 2	Topsoil		
	2 - 12	Fill - Medium Dense Gray Brown Silty Fine SAND	12	15/1.75"
	12 - 22	Loose Tan Slightly Clayey Silty Fine SAND (Wet)	24	4-5-6
	22 - 60	Medium Dense Brown, Yellow, Tan Clayey Fine SAND (Wet)	42	5-5-7
			60	8-15/1.75"
B-3	0 - 3	Topsoil		
	3 - 12	Fill - Loose Tan Slightly Clayey Silty Fine SAND (Wet)	12	10-9-9
	12 - 48	Loose to Very Loose Gray, Orange Clayey Medium to Fine SAND (Wet)	24	5-5-5
	48	Utility - Water Line ?	42	2-3-3
B-4	0 - 2	Topsoil		
	2 - 24	Fill - Loose Gray, Tan Silty Fine SAND w/ Trace of Clay (Wet @ 12")	12	6-7-6
	24 - 54	Medium Dense Orange Clayey Medium to Fine SAND (Dry @ 24")	24	8-15/1.75"
	54 - 66	Medium Dense Gray, Tan Clayey Medium to Fine SAND	42	15+
			60	15+
B-5	0 - 4	Topsoil		
	4 - 14	Fill - Medium Dense Silty Tan Fine SAND	12	15/1.75"
	14 - 20	Fill - Medium Dense Gray, Tan Silty Medium to Fine SAND	24	15/1.75"
	20 - 36	Medium Dense Tan, Gray Silty Fine SAND	42	5-8-10
	36 - 66	Loose to Medium Dense Orange Clayey Medium to Fine SAND (Wet)	60	10-15/1.75"

TABLE 2

PAVEMENT DESIGN CALCULATIONS

Street: **Nicodemus Mile Road Widening**

ADT: 8500

CBR: 12 Percent

Pavement Design Life: 20 Years

Growth Factor $G = (1 + i)^n$ 1.486

i 0.02
n 20

Design Avg. Daily Traffic ($\overline{ADT}$) $\frac{ADT + (G \times ADT)}{2}$ $\overline{ADT}$ = 10565

Truck Factor ($\overline{N}$)
x = % Single Frame Trucks
y = % Multiple Frame Trucks

$\overline{ADT}$ (0.25x + 0.60y)

N = 169.0

x = 4%
y = 1%

Soil Support Value (SSV) 5.32 (log CBR))-1.52

SSV = 4.221

Structural Number (SN) $\frac{(2.41\ (\overline{N})^{0.151}}{(1.14)^{SSV}}$

SN = 3.01

Recommended Section

Street	Required Structural No.	Asphalt (Inches)	Aggregate Base Course (Inches)	Actual Structural No.
Nicodemus Mile	3.01	4.00	9.00	3.02
Street	**Required Structural No.**	**Asphalt (Inches)**	**Cement Stabilized Base Course (Inches)**	**Actual Structural No.**
Nicodemus Mile	3.01	4.00	6.50	3.06

GeoTechnologies, Inc

Job No: 1-08-0258-CA Date: 6/9/08

Job Name: Nicodemus Road

Job Location: Rocky Mount, North Carolina

Boring No:

Sample No: S-1

Depth:

TEST RESULTS

Method of Test: ASTM D 698

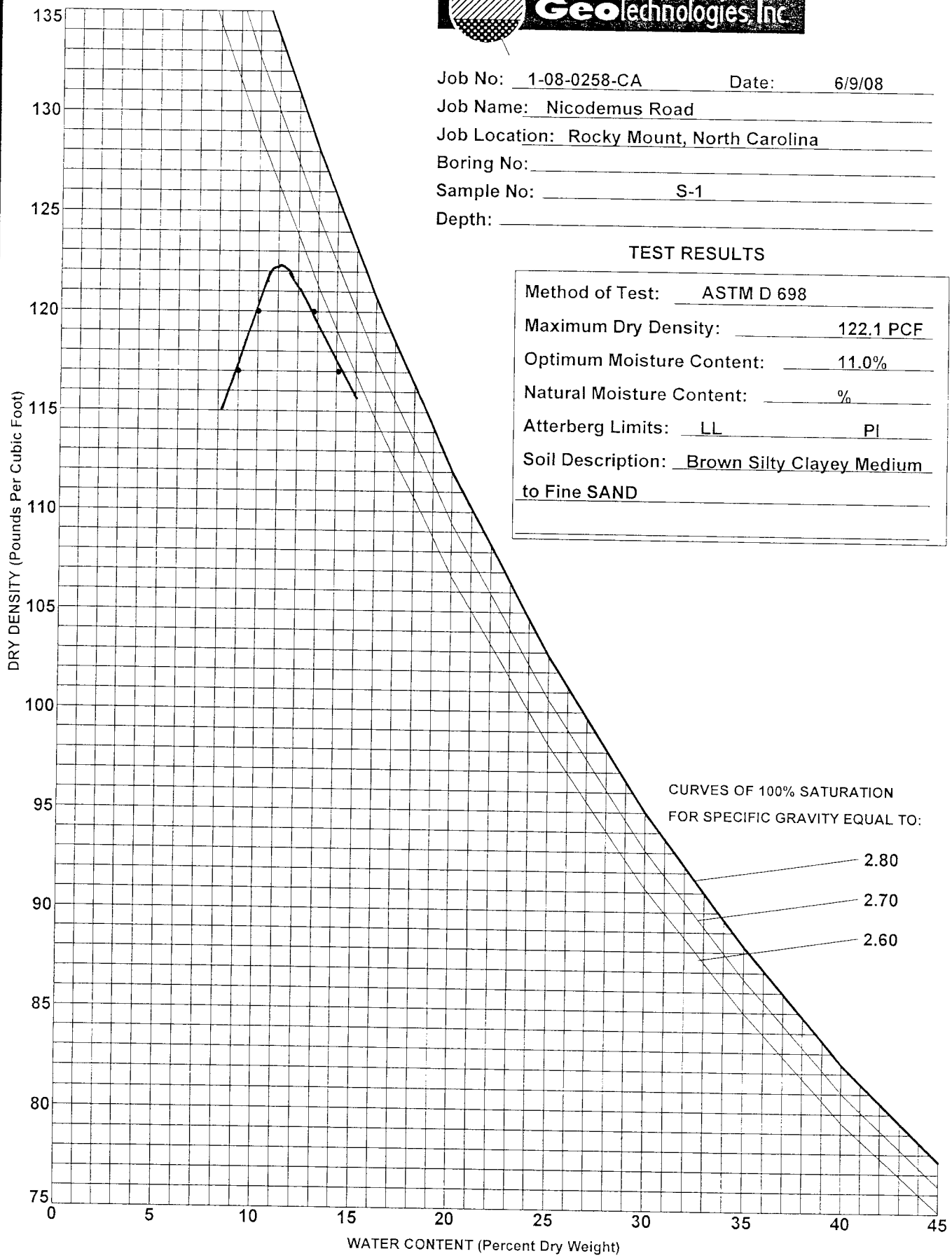
Maximum Dry Density: 122.1 PCF

Optimum Moisture Content: 11.0%

Natural Moisture Content: %

Atterberg Limits: LL PI

Soil Description: Brown Silty Clayey Medium to Fine SAND



MOISTURE-DENSITY RELATIONSHIP

GeoTechnologies, Inc. PA

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CBR DATA SHEET

JOB #: 1-08-0258-CA

JOB NAME: Nicodemus Road Widening

DATE: 4/30/2008

SAMPLE I.D. S-1 DEPTH:

NOTES: PROCTOR DATA:

Opt. Moisture = 11.0%

Max. Dry Density = 122.1 PCF

TEST PROCEDURE: ASTM D 698

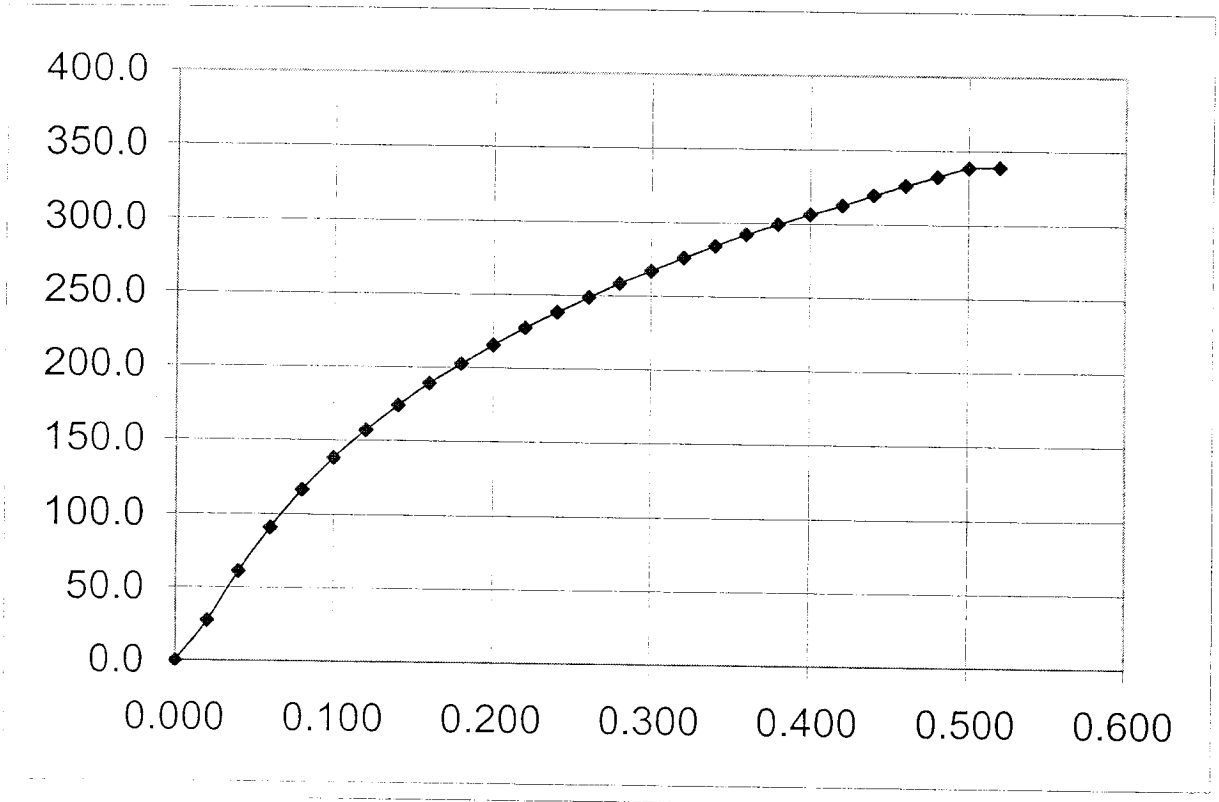
SOIL DESCRIPTION: Brown Silty Medium to Fine Sand

CBR SPECIMEN DATA		Swell Data	
MOISTURE CONTENT	11.0%	Initial Reading	0.198
WET DENSITY	132.9 lbs./cu.ft.	Final Reading	0.200
DRY DENSITY	119.7 lbs./cu.ft.	Mold Height	4.580
% COMPACTION	98.1 %	% Swell	0.04

LOAD CELL 2000 LB.

RATE OF DEFORMATION .05 in./min.

SURCHARGE USED 10 lbs.



CBR @ 0.1"	13.8
CBR @ 0.2"	14.4
% SWELL	0.0